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SAMOS

ANNEX "A"

Description of Existing SAMOS Systems

To a first approximation a satellite orbit has an orientation which is fixed with respect to the stars. The earth rotates under this orbit. The orbit can be oriented so that it goes around the earth's pole and in a plane connecting the earth and the sun. Such a satellite would always cross the earth's surface at 12:00 noon, or midnight. In effect, the satellite would cover the earth at high noon and would have maximum illumination for any photography. The distance the earth turns between successive orbits is determined by the satellite's period, the length of time it takes for a complete orbit. This, in turn, is determined in the case of a circular orbit by the height of the satellite above the ground.

The main advantage of using a satellite for reconnaissance is its ability to photograph large areas in very short time periods. The main constraints are weather, lack of directional control, darkness, economic and political factors in the form of diplomatic protests, international treaties, international space rules and regulations, and ethics. In determining the objectives and requirements of a satellite reconnaissance program, justification should exploit to the maximum all of the inherent advantages to insure effective and efficient results. The operations aspects of the program should be consistent with the objectives and the requirements and should minimize any or all of the limitations that are inherent in the constraints.

The SAMOS photographic system is composed of the E-1, E-2, and E-5 airborne packages, and is supported by Subsystem H and Subsystem I; the ground transmission reproduction and data reduction systems.

The E-1 and the E-2 systems are designed to obtain photographs of military importance from an earth satellite 270 miles high. After the photographs are taken, the film is processed in the air and the negative image is converted into an electrical signal suitable for radio transmission to a ground station. The ground station receives the signal and translates it into a permanent, reproducible photographic record.

The cameras uses a variable slit and the movement of the film across the slit to control exposure time. The principle is similar to a focal plane camera where the shutter is moved across the film to control exposure. The type of film that is used is a high resolution, low speed type known as SO 29.3 or microfile. The monobath process is used for inflight processing and may be likened to the Land-Polaroid process. The processed film is then presented to a gate to be scanned by a flying spot scanner and related optics. Here image resection occurs and a 2x2-inch frame is scanned in 0.1"x2" strips for the data link transmission. The ground-based communications equipment (Subsystem H) utilises the video signal to reconstruct the original film image that existed in the vehicle. Reconstruction is accomplished by photographing a moving spot of light displayed on a cathode ray tube while the brightness of the spot is moved in response to the video signal. The image of a succession of spot transversals appears to the eye as a line on the fact of the tube, but when this image is spread out on a continuously moving recording camera film, a reconstructed picture is obtained.

The E-1 is a fixed camera and covers a 100-mile swath on the ground, perpendicular to the line of flight. The E-2 is stabilized in a rotable mount which provides coverage 17 miles wide within 150 miles of either side of the vehicle. The E-1 is not read-out limited, but the E-2 is limited in this respect.

The E-5 is a recoverable transverse panoramic camera and covers a strip of the ground across the line of flight 60 miles. The camera has roll steering (30°) for specific objective targeting and for avoiding adverse weather conditions. It also has a new technique for obtaining stereo coverage. The film is exposed by panoramic scan, i.e., the rotation of the lens about its nodal point and a separately driven curtain type shutter controls the exposure. The film is recovered and processed according to existing conventional methods.

A comparison of the E-1, E-2, E-5, with two proposed technically feasible systems is listed below. The 24" camera is a panoramic type available now. The 36" camera can be a panoramic type or utilize a rotating optical system and be available in approximately twelve months.

	E-1	E-2	E-5	24" Pan	36" Pan
Performance focal length	6"	36"	66"	24"	36"
Altitude	260 mi.	280 mi.	180 mi.	127 mi.	142 mi.
Ground Resolution	100"	20'	5'	25'	6'
System Resolution	100 11/mm	100 11/mm	100 11/mm	80-100 11/mm	140 11/mm
Strip width mi.	100	[illegible]	60	150	300
Aperture	40	4.0	5.0	5.6	3.5
Shutter Speed	1/50	1/100	1/70-1/700	1/300-1/2000	1/4000
Center Scale	$3x10^6$	$5x10^5$	$7.5x10^4$	$3.5x10^3$	$2.5x10^4$
Life Min. Expected R&D	15-30	30-60	30	1-4	1-4
Coverage/Vehicle Life	42 M Sq Mi	6.7 M Sq Mi	15-20 M Sq Mi	Can carry only 1 day of film 7.3 M Sq Mi.	4 M/Day 14.6 M Total
Film Size	70 mm x 1200'	70 mm x 4520	5" x 15-2200'	70 mm x 2500'	1500' x 5"
Effective Stereo	No	No	Yes	No	Yes

Note: Based on 3 TDA stations 68 minutes of readout are available. With only Vandenberg 25 minutes of 36% of coverage. With VAFB and NE TDA stations 53 minutes or 78% of coverage.

The effectiveness of VAFB as an operation T&A station is questionable. The amount of read-out will depend on the type and amount of activity at the Pacific missile range, and the degree that the electronic radiations of these activities interfere with subsystem H and blanks out subsystem H reception.

The amount of read-out for the available T&A stations is as indicated:

1 T&A = 20,750 Sq. Mi. per day
2 T&A = 41,500 Sq. Mi. per day
3 T&A = 55,000 Sq. Mi. per day

Growth potential of any system is an important consideration because of: (a) increased intelligence gathering capability; (b) increased area coverage capability; and (c) increased reliability by reducing the maximum operating rates by a factor of 2:1. At the present time the 24" system listed above has the following potential and could possible result from minor changes:

1. The addition of a 36" F.L. lens with a system resolution of approximately 140 ll/mm.

2. A 100% increase in ground coverage due to increased film width and capacity (70 mm to 5").

3. A higher reliability factor by cutting the number of frames or exposures by 50% for every pass.